LETTERS TO THE EDITOR

Predicting survivorship after coronary artery bypass grafting in patients with low ejection fraction

To the Editor:

We read with great interest an editorial by Dr. Wechsler[1] on coronary bypass grafting in patients with an ejection fraction of 20% or less. In this editorial, Dr. Wechsler emphasized the need to identify a subset of patients who benefit from coronary artery bypass grafting, regardless of the presence of low ejection fraction. He stated that a predictive scoring system was lacking that took into account most of the clinical and hemodynamic parameters as descriptors of left ventricular performance. He also claimed that he had not seen a series that combined parameters mathematically to evolve a risk score based on the important interaction between the critical risk elements.

In this letter, we would like to point out our recent study[2] published in the Journal in 1995, in which we tried to develop exactly the indicator Dr. Wechsler describes. In our study we sought to elucidate the relation between the preoperative parameters and the survivorship after coronary artery bypass grafting for patients with low ejection fraction (mean ejection fraction of 23% ± 7%). We used a technique called *factor analysis* to "summarize" a number of preoperative parameters. Preoperative clinical variables, as well as hemodynamic parameters from exercise stress and nitroglycerin challenge tests, were screened and entered into factor analysis to produce a score for predicting the life status (alive or dead) 4 years after the operation. We found that the most highly loaded parameters predicting survivorship were related to the exercise stress test (specifically, cardiac index and systemic vascular resistance) and nitroglycerin challenge (specifically, stroke index and cardiac index). A history of congestive heart failure was also predictive. Ejection fraction itself and the response of ejection fraction to exercise stress or nitroglycerin challenge were not useful parameters to predict the outcome. More important, a newly developed score (which we called *cardiac function factor*), derived from factor analysis, provided a predictive value superior to that of any individual variable. By performing logistic regression analysis, we were able to predict survival by entering individual variables to calculate cardiac function factor.

Our series was relatively small (56 patients), and the study was not done prospectively. For surgeons and cardiologists interested, prospectively, in studying patients with low ejection fraction, we strongly encourage them to include a preoperative exercise stress test in the protocol. In our study, the 7-year survival was 78% in the patients who had a cardiac index greater than 3.5 L/min per square meter at exercise, whereas only 29% of patients survived who had an exercise cardiac index less than 3.5 L/min per square meter. This is an easy number to obtain. Maximal oxygen consumption may be used as a noninvasive alternative to cardiac index. Left ventricular volume or echocardiographically measured ventricular dimension should be determined. The usual formula of "large ventricle = bad ventricle" may not apply in this subset of patients.[3] If possible, a load-insensitive parameter of contractility and the diastolic property of the ventricle should be taken into account. The underlying mechanism of altered survivorship should also be sought. We agree with Dr. Wechsler that much remains much to be done to identify the subset of patients with low ejection fraction who benefit from coronary artery bypass grafting. As Dr. Wechsler pointed out, this is an area still ripe for new investigation.

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REFERENCES

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2. Morita S, Zubiate P, Kay GL, et al. Prediction of long-term survival by preoperative exercise testing in patients with depressed ejection fraction undergoing myocardial revascularization. J Thorac Cardiovasc Surg 1995;110:944-51.
3. Morita S, Kay GL, Zubiate P, Mendez M, Kay JH. Diastolic function determines the cardiac output in patients with low ejection fraction secondary to ischemic heart disease. Circulation 1989;80(Suppl):II275.

12/8/78758

Reply to the Editor:

The response to my editorial by Dr. Morita and his colleagues is much appreciated. I was aware of their article before the time of my writing. They are to be commended for taking on a tough task and using a sound method for establishing a predictive index of long-term survival after coronary bypass grafting in patients with reduced ejection fraction. The concept of factor analysis is sound and can serve as an amplifier of parameters that are independently of marginal significance but which, when combined, become more meaningful. Their article had a few shortcomings, which they acknowledged. These include the retrospective nature of their study, small numbers that may have been inadequately powered to detect important differences between groups, and an absence of focus on perioperative mortality. The wisdom of their approach was in combining an exercise variable that served as a surrogate for the efficacy of adaptive mechanisms in compensating for diminished ejection fraction in their patient population. As regards predicting operative mortality, similar measured parameters should be helpful but might be better analyzed in cohorts of patients in which the focus is even more heavily on those with low ejection fractions. In addition, readers of all such articles are reminded that every patient entered into the